INDEPENDENT LUBRICANT MANUFACTURERS ASSOCIATION

JUL 16 2004

July 16, 2004

By Overnight Courier
Dr. C.W. Jameson, Ph.D.
National Toxicology Program
79 Alexander Drive
Building 3118
Research Triangle Park, North Carolina 27709

Re: Report on Carcinogens Comments

Dear Dr. Jameson:

The Independent Lubricant Manufacturers Association ("ILMA") submits the enclosed comments on the nomination of metalworking fluids for review for the Report on Carcinogens, 12th Edition ("RoC"). 69 Fed. Reg. 28940 (May 19, 2004). For the reasons set forth in the comments, the Association does not believe that metalworking fluids meet the criteria for listing in the RoC.

Drs. William Lucke and David Savitz assisted ILMA in the preparation of its comments. Dr. Lucke is a chemist who retired after a distinguished career with Milacron Marketing Company. He has delivered a number of papers on measuring metalworking fluid mists and has published papers on toxicology testing of metalworking fluids. Dr. Savitz is the Cary C. Boshamer Distinguished Professor and Chair of the Department of Epidemiology at the University of North Carolina's School of Public Health. The Association's Safety, Health, Environmental and Regulatory Affairs Committee, which is composed largely of toxicologists and industrial hygienists, reviewed and provided input into ILMA's comments.

ILMA requests the ability to submit at a later date a study by Susan Arnold and Mike Jayjock. We anticipate that their manuscript will be published in the near future in a peer-reviewed journal. An element of their analysis is a discussion of the need to establish a link between exposure to an agent and an etiologic outcome, which ILMA believes is missing in the Eisen and other studies that formed the basis of the nomination of metalworking fluids for review for the RoC.

Our contacts for this matter are our counsel, Jeffrey L. Leiter, and me. I can be reached at the letterhead address or by email at cpowers@ilma.org.

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ILMA appreciates this opportunity to submit our comments. We look forward to participating as appropriate in the review process.

Sincerely,

Celeste Powers

Celeste M. Powers, CAE
Executive Director

Enclosure

cc: SHERA Committee
Dr. William Lucke
Dr. David Savitz
Jeffrey L. Leiter, Esq.

Comments of the Independent Lubricant Manufacturers Association (ILMA) on "Metalworking Fluids: Summary of Nomination for Review: NTP 12th Report on Carcinogens, September 2003 Submitted by Report on Carcinogens Group, NIEHS"

Summary

The composition of metalworking fluids is complex, both with regard to the fluids in current use and with the significant changes in the composition of these fluids over the last 50 years. The epidemiologic evidence for metalworking fluids cited by NIOSH – and relied upon for the nomination for the Report on Carcinogens (RoC) -- is derived primarily from a series of studies at three automobile parts manufacturing plants. These studies reflect potential health effects of the metalworking fluids used at these three particular plants during the periods that were evaluated – that is, at least 20 years in the past. Evidence from these studies includes associations between metalworking fluid exposures and specific types of cancer; however, there is little or no corroboration for those findings from other studies.

As recognized by NTP, hazard assessment of mixtures is difficult. Based on the complexity and diversity of the composition of metalworking fluids, the changes in formulations to remove suspect chemicals, and the changes in the technical specifications for machining over decades, it is impossible to make generalized conclusions based on the old data that studied only a small fraction of the fluids that were in use in past decades.

The epidemiology and toxicology studies were not designed to make conclusions about all metalworking fluids in general. Workplaces were randomly chosen based on availability of funding or a perceived need to study a particular worksite. The few toxicity studies used fluids that were available at the times those studies were conducted.

As discussed below, the fluids employed in most toxicology and epidemiology studies are insufficiently characterized by composition and type to make any valid conclusions that can be extended to metalworking fluids in general. Moreover, most epidemiology studies involved exposures to fluids significantly different in composition than those used today. Updates on these epidemiology studies are useless for this same reason. There are no mechanistic data to explain the findings nor is there any credible evidence to ascribe cause to a given chemical substance or a group of chemical substances.

Given the marked variation in the composition of metalworking fluids across settings and over time, and the limited ability of available epidemiologic studies to isolate effects of critical components, classification of all current metalworking fluids as human carcinogens or reasonably anticipated human carcinogens in the aggregate is not justified by the available research.

NIOSH, OSHA and the courts have reviewed the epidemiology studies. None of these bodies found cause for regulatory action in the data.

The studies suggest, at best, there may have been associations in the past between exposure to some metalworking fluids and cancer. None of the associations were strong enough to support finding a causal relationship between exposure and cancer, at any

body site, then or now. Metalworking fluids do not meet the criterion for a known human carcinogen.

Any association, even if real, between exposure to straight oils, soluble oils and a small number of synthetic or semi-synthetic fluids in the past would be irrelevant as "credible evidence" to classify all metalworking fluids as "reasonably expected to be a human carcinogen" for the fluids in use in the 21st century.

ILMA believes that there is insufficient information for NTP's review and strongly urges the RG1 Subcommittee to terminate the nomination for metalworking fluids.

Introduction

ILMA is a national trade association of 142 North American manufacturing member companies, consisting largely of small businesses. As a group, ILMA's members manufacture approximately 80% of the metalworking fluids used in North America. ILMA members developed and operate LubeCare®, the product stewardship program for the lubricants industry. The Association recently entered into an alliance with the Occupational Safety and Health Administration (OSHA) to promote the safe use of lubricants and to provide metalworking fluid (MWF) users with educational and outreach information. Accordingly, ILMA and its members have a direct interest in the nomination of metalworking fluids for listing in the RoC, which was published in the May 19, 2004 *Federal Register.*

Metalworking fluid industry profile

As recognized by NTP in its May 19 notice, metalworking fluids are diverse, complex products designed for a multitude of specific applications in the machining environment. Metalworking fluids are highly developed and engineered products used for the removal of metal, metal forming, metal protecting and treating, and metal cooling. However, MWF formulations have evolved and have changed significantly over time both to enhance the fluid for its intended application and to address suspicions of adverse health effects from exposure to former MWF components, such as poorly-refined base oils and nitrites. These MWF formulation changes have been recognized by other Federal agencies (*e.g.,* NIOSH and OSHA) and by the courts.

Metalworking fluids fall into four classes. "Straight oils" are used without dilution and are formulated from mineral oil, often with other additives for added lubricity or corrosion control. The other fluid types are diluted with water before use. They are supplied as concentrates and the customers dilute with available potable water. "Soluble oils," also referred to as "emulsion fluids," do not contain water in the supplied concentrate, but are emulsified by the end user before use to become opaque, milky solutions. "Semi-synthetic fluids," sometimes called "preformed emulsions," contain mineral oil emulsified into water. These are also diluted by the user before use and become translucent. "Synthetic, or solution, fluids" contain no mineral oil and are true solutions rather than emulsions. The concentrates are also diluted with potable water before use and remain transparent.

There are some fluids that do not fall neatly into a single class. Some fluids based on synthetic hydrocarbons or vegetable oils, used without dilution, are referred to as synthetics; as are similar products formulated with emulsifiers, similar to soluble oils. These tend to be a very small part of the market.

Compositions of these fluid types are summarized in Tables 1-4 (extracted from Lucke, 1997).

Any individual fluid is a formulation that may include as many as 20 different components. Many of these components can be complex mixtures themselves. Over 700 unique CAS (Chemical Abstract Services) Numbers have been identified as being present in commercial fluids.[1] The majority of these numbers have been assigned to mixtures of chemicals and not to discrete chemical compounds. Many additives sold to formulators are blended packages that have no assigned CAS number. The United States market for all metalworking fluids is estimated to be 246.6 million gallons, of which, 117.2 million gallons are metal removal fluids (straight oils, 27.3 million gallons; soluble oils, 49.3 million gallons; semi-synthetics, 21.7 million gallons; synthetics, 18.9 million gallons).

Several hundred fluid formulators have had products in the marketplace over the last 50 years, each with multiple fluids in their product line. Any national supplier must, by necessity, have a broad range of products. The machining of iron parts for earth-moving equipment in Peoria cannot use the same fluid used in machining aerospace alloys for airplane components in Seattle, and a completely different fluid is needed to grind bearings in Georgia. The processes are different, the workpiece is different, the local water used for dilution is different, and the metalworking fluid must be different.

As is true for all industry, there has been a substantial consolidation of the industry over the recent past. Even so, the ten largest manufacturers supply about 50% of the volume of metal removal fluids; leaving the remaining 60 million gallons divided among many sources.

Clearly, the universe of metalworking fluids is, has been and will continue to be diverse

When fluids are used in a manufacturing plant, they can become contaminated by lubricating and hydraulic oils, dirt particles, dissolved metals, metal oxides, abrasives, process solvents, cleaners, rust preventative compounds, mop water, food scraps and human waste. Any substance in the plant has the potential to find its way into the metalworking fluid system. Additionally, in-use water-miscible metal removal fluids are likely to be subject to microbiological degradation.

Clearly, metalworking fluids are a class of agents defined largely by their use, not by their constituents. All fluids will have similar physical properties, but their chemical properties will be less similar and the toxicological properties of any given fluid will be comparable to those of another fluid only to the extent that they have the same components.

Historical changes in metalworking fluid formulations

Although the use of water and animal fats in metalworking can be traced back at least as far as Leonardo da Vinci, widespread use of fluids was driven by the growth of the automobile and aircraft industries. (McCoy, 1994) Straight oils became available after the discovery of mineral oil in 1859. Use of crude synthetics (*e.g.,* water and sodium carbonate) began as early as 1883. Soluble oils came into use around 1915, semi-synthetics in 1947, and modern synthetics around 1950.

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[1] Bill Watt, Daimler Chrysler, oral presentation at ACGIH Mineral Oil Mist System Symposium 2002.

In the period between 1950 and 1984, improvements in the oil refining process resulted in progressive reductions in the polynuclear aromatic (PNA) content of base stock oils and a corresponding reduction of their carcinogenic potentials. Formulation changes in straight oils themselves included discontinuing the use of kerosene (cancer and fire safety), sperm oil (conservation concerns) and polychlorinated biphenyls (environmental concerns). The practice of using chlorinated solvents (cancer concerns) as tapping fluids was eliminated.

Changes in water-based fluids between 1970 and 1984 included the elimination of alkali metal nitrites (and the potential for contamination by nitrosamines), chromates (cancer concerns) and para-tert-butylbenzoic acid (testicular atrophy) in semi-synthetic and synthetic fluids and the replacement of naphthenic acids (cancer concerns) by petroleum sulfonates in soluble oils. There was also a reduced use of phenolic biocides (environmental concerns) in fluid formulations and as tank-side additives.

With the promulgation of the Hazard Communication Standard by OSHA in 1985, the use of severely solvent-refined or severely-hydrotreated base stock oils became general practice. The use of short-chain chlorinated paraffins (cancer concerns) was also sharply reduced. The substantial reformulation of MWFs has been recognized by NIOSH and OSHA.

Changes in metalworking fluid formulations have not been driven entirely by health or environmental concerns. The metalworking manufacturing industry has changed drastically over the last 50 years. Improvements in process efficiencies, conversions from iron and steel to non-ferrous metals, ceramics and plastics and reductions in the size of central systems have completely changed the definition of an acceptable metalworking fluid. A fluid from the 1950s would be as relevant in today's market as the original Model T Ford would be on an interstate highway.

Regulatory activities since 1993

In December 1993, the United Auto Workers (UAW) asked EPA under Section 4 of the Toxic Substances Control Act for a test rule aimed at the components of metalworking fluids. At the same time, the union petitioned OSHA to issue an Emergency Temporary Standard under Section 6(c) of the Occupational Safety and Health Act ("OSHA Act) to lower the PEL to 0.5 mg/m^3.

Both EPA and OSHA denied the UAW's petitions, indicating that, while the issue had merit, metalworking fluids were too broad and too complex to regulate. While neither Agency precluded future regulation, they remanded the issue at that time to the "ONE Committee" -- a standing committee among OSHA, NIOSH, and EPA that reviews mutual interagency concerns.

NIOSH held a two-day meeting in November 1994 on its draft "Hazard Review" on metalworking fluids. Two concepts clearly emerged from this meeting: (1) the tremendous complexity of metalworking fluids and the issues surrounding the fluids, and (2) that the expertise on the subject resided primarily with MWF users and fluid formulators/manufacturers.

Also in November 1994, OSHA held four public meetings on its "Priority Planning Process." The Agency sought input on a "top 20" priority list for regulatory and non-regulatory action from among a list of more than 125 health and safety hazards. There was considerable testimony that, while the issue of metalworking fluids is of concern and that the current PEL provided inadequate protection, there are far more pressing priorities for OSHA and that the Agency should expend its limited resources elsewhere when there were ongoing and substantial voluntary initiatives toward improved MWF formulations, increased systems control and reduced exposures.

In December 1995, and without response to the above-noted comments, OSHA issued its priority list, which included 18 individual areas, with metalworking fluids being designated as one of five for rulemaking as other standards were completed and resources became available. In its priority planning process document, OSHA noted that a reason that it selected metalworking fluids for a rulemaking was the "considerable interest within both business and labor in working with government agencies to find ways to reduce worker exposure." At the same time, the Agency also said:

> Because usage patterns, chemistry and toxicology of these materials is very complicated, it has been difficult to determine precise links between specific fluid formulations or specific ingredients with specific health effects in exposed workers.

Joe Dear, then OSHA Administrator, asked the National Advisory Committee on Occupational Safety and Health (NACOSH) for a recommendation on how to proceed (*i.e.,* advisory committee, "traditional" Section 6(b) rulemaking, or negotiated rulemaking). NACOSH recommended in May 1996 that OSHA establish a Standards Advisory Committee under Section 7 of the Occupational Safety and Health Act. A critical issue to NACOSH in making its recommendation was whether a regulatory (standard) or non-regulatory (guideline) approach should be taken to mitigate any MWF hazards. OSHA published a *Federal Register* notice in August 1996, soliciting nominations for the advisory committee.

In February 1996, NIOSH inexplicably abandoned its "Hazard Review" document and instead released a draft "Criteria Document for a Recommended Exposure Level (REL) to Metalworking Fluids" for public comment. The REL was 0.5 mg/m3 as total particulate, not mineral oil mist as in the current PEL. NIOSH downplayed the cancer issue in its document; basing the draft REL largely on three unpublished, non-peer reviewed respiratory effects studies.

In July 1997, OSHA announced the formation of its Metalworking Fluids Standards Advisory Committee (MWFSAC), naming the 15 members of the committee. The first of ten meetings of the MWFSAC was held September 1997. Then OSHA Administrator Charles Jeffress asked the MWFSAC to investigate various regulatory and non-regulatory options. The MWFSAC's Final Report notes that while the OSHA Administrator "emphasized a focus on best practice activities for protecting workers in the MWF environment, individual committee members has their own individual perspectives on what the committee should accomplish.

In July 1999, at the final MWFSAC meeting, the committee agreed to issue formal majority and minority opinions and recommendations to OSHA. The non-unanimous recommendation was for a Section 6(b) rulemaking with a PEL of 0.5 mg/m3 (0.4 mg/m3 thoracic), implementation of medical monitoring and surveillance programs, and publication of "best practices" for MWF management The minority recommendation was not to begin formal rulemaking, but rather to allow the substantial voluntary initiatives already ongoing to proceed with OSHA assisting those efforts through consultation and outreach.

After reviewing the evidence for an association between metalworking fluids and cancer, the committee made the following observations:

Skin Cancer The majority opinion was that skin cancer is known to be associated with exposure to old formulations of metalworking fluids. Ten (10) members held this majority opinion. The opinions were mixed for current formulations of metalworking fluids. One member believed that old formulations were a problem. Two members believed there was no evidence for current formulations. Three members viewed evidence for current fluids as equivocal. One member thought it was reasonably anticipated that there was evidence for current fluids. Three members believed there was known evidence for old and current formulations. The minority opinion (three members) was that the evidence was equivocal for old formulations. As noted, the opinions for current fluids were mixed. The members who presented the minority view on the older formulations believed there was no evidence for current formulations. Two members did not think they had adequate information to make a decision on the issue of skin cancer.

Cancer at Other Sites The majority opinion was that old formulations of metalworking fluids are known to cause cancer at various sites. Ten members held this majority opinion. The minority opinion (three members) was that the information on the older formulations was equivocal. The inconsistencies among the epidemiological studies regarding sites were noted for a rationale. Two members had no opinion.

The committee was split on the issue of cancer related to current formulations of metalworking fluids. Four members viewed that evidence was equivocal for current formulations. Four members viewed the evidence as reasonably anticipating cancer associated with current fluids. Three members thought there was no evidence that currently formulated metalworking fluids cause cancer. Three members noted that prudence dictates that we view current formulations as carcinogenic, and one had no opinion.

Mr. Jeffress told the MWFSAC at its final meeting in July 1999 that the Agency would pursue the non-unanimous recommendation for a revised PEL for metalworking fluids "as time and resources allow." Mr. Jeffress also told the panel that OSHA would publish best practices compiled by the MWFSAC for metalworking fluids. He commented that the unanimous recommendation for a management systems approach to controlling metalworking fluids is the most important concept that the MWFSAC advocated.

On November 14, 2001, OSHA issued a MWF best practices manual. Available at HYPERLINK "http://www.osha-slc.gov/SLTC/metalworkingfluids/metalworkingfluids_manual.html" http://www.osha-slc.gov/SLTC/metalworkingfluids/metalworkingfluids_manual.html. The Agency's manual included many of the MWFSAC's systems management points.

In its semi-annual regulatory agenda in December 2001, OSHA indicated that it had withdrawn metalworking fluids as a priority for rulemaking. The Agency indicated that its decision was based in part on resource constraints and the fact that the MWFSAC "divided on the appropriate response" to the regulation of metalworking fluids.

In October 2002, ACGIH sponsored a symposium on mineral oil mist to provide background on a proposed TLV for metalworking fluid mist exposures. Many of the concerns raised in these comments were also discussed during the meeting. Subsequently, ACGIH has removed Appendix B, Substances of Variable Composition from the TLV book. TLVs are now to be focused on single-substances. ILMA is asking ACGIH to drop MWFs from "under study" for the same reasons cited by ACGIH in dropping Appendix B. ILMA believes that such poorly defined substances, including metalworking fluids, require a systems approach to control, and should not be on the TLV list or on other lists, such as the RoC.

On March 22, 2004, the U.S. Court of Appeals for the Third Circuit dismissed a suit filed against the Secretary of Labor by the UAW and the International Steelworker's Union, asking the court to order the Agency to promulgate a PEL for metalworking fluid exposures. In dismissing the unions' petition, the Court, in part, held that "...the evidence supporting a connection to cancer is equivocal."

Evaluation of epidemiologic evidence

The epidemiologic evidence pertaining to carcinogenicity of metalworking fluids offers some relatively firm conclusions. It is clear that, in the past, *some* metalworking fluids contained or generated agents known to be carcinogenic and exposures to these fluids resulted in increased cancer risk. In particular, exposure to polynuclear aromatic hydrocarbons was historically associated with scrotal cancer and other forms of skin cancer.

The literature and evidence pertaining to the more modern era of metalworking fluids is less clear with regard to both study findings and their interpretation. There are scattered reports of associations between occupational exposure to metalworking fluids or to some specific type of fluid and virtually every cancer site, as correctly stated in the NIOSH review and the summary of that review. It is also entirely possible that one or more of those associations is indicative of an etiologic relationship between some form of metalworking fluids and some type of cancer in humans.

As one looks to the literature for more specific associations, beyond job category or metalworking fluids in the aggregate, the adequacy of the epidemiologic literature becomes more questionable. The next level of sophistication in assessment pertains to the broad classes of metalworking fluid (*i.e.,* straight, soluble, synthetic, and semi-synthetic). This reflects an attempt to isolate a more specific form of exposure to derive more accurate exposure data for assessment in epidemiologic studies.

With this refinement, the body of relevant literature declines considerably, with increasing need to rely solely on the series of studies of Eisen and colleagues at a particular set of three auto parts manufacturing plants in Michigan.

Across the various forms of metalworking fluids evaluated and the many cancer sites considered, a number of associations were found, in the original papers, the case-control studies nested within the cohort, and in the more extended cohort follow-up. As reviewed previously (Savitz, 2003), the most credible such associations were for straight metalworking fluids and rectal and laryngeal cancer, and for soluble metalworking fluids it was laryngeal cancer. In contrast, the summary of the evidence in the report to the National Toxicology Program notes a series of associations across cancer types from both the earlier and more extended follow-up of the auto parts manufacturing workers.

Examining a series of exposures and cancer sites for varying subsets of work experience defined by location and calendar time yields an array of results that call for scrutiny and interpretation. The precision, magnitude of increase, and corroborative evidence from other epidemiologic studies needs to be factored in to draw even a tentative conclusion. Given the need for replication in particular, no matter how strong the individual study, most, if not all, of these associations are based on very limited data.

As stated above, it is possible that one or more of these associations does reflect some causal relationship, but simply listing each association found without elaboration conveys the impression that because of the sheer numbers of associations reported, some are certain to be causal. This is not accurate

The next level of refinement in evaluation would consider changes in exposure over time within class of metalworking fluids (*e.g.,* straight oils before 1980 versus after 1980 or water-based fluids before and after 1985). The goal is to classify exposure more accurately and the specificity of a given class of fluids is likely to be enhanced by restricting on calendar time.

For example, in the studies reported by Eisen (Eisen et al., 1992), (Eisen et al., 2001), Plant 1 was the oldest facility, opening in 1917 and contributing 64% of the deaths studied in the first analysis. The average length of exposure at this plant is listed as 29 years, so that half of all first exposures would have been prior to 1954. For Plant 2, operations began in 1938. The average length of exposure was 19 years; half of all exposures would have started in the period between 1938 and 1964. For the studies from these plants to be applicable to metalworking fluids used at present, the findings would need to be extrapolated from the 1940s to the present, despite major changes in constituents and exposure over that period as noted above.

Some of the differences found in the most recent follow up of the Michigan auto parts manufacturing workers are cited in the NTP evaluation, with some associations stronger in the more recent period, and some weaker. Again, it is possible that those are reflective of causal relationships, but the precision is diminished as subsets of exposure are considered and there are literally no other epidemiologic studies to look to for corroborating or refuting those patterns.

For example, the association of pancreatic cancer with exposure to synthetic (or semi-synthetic) fluids was based on results from Plant 2, (Bardin et al., 1997) where the presence of nitrosamines in at least some of these fluids was inferred from the presence of both nitrite and amines in a fluid. Such exposures could have been present between 1950 and 1985, and may have increased cancer risk; but if those were the contributing factors, the introduction of nitrite-free fluids between 1978 and 1985 would have reduced or eliminated such excess risk.

The conclusion as stated "modest risk of several cancers may persist at current levels of exposure to water-based metalworking fluids" is valid but answering the question requires additional evidence and the plausibility (how likely is it?) depends on other considerations from the toxicology and industrial hygiene of metalworking fluids.

The ideal assessment would require knowledge of specific constituents in metalworking fluids hypothesized to be carcinogens. With some index of that effective exposure, the associations would presumably become much stronger to the extent that the causative component is measured with specificity, and extrapolation across settings, time periods, and exposure conditions would be feasible. That is, the "exposure" axis would be based on the intensity of exposure to certain constituents found in metalworking fluids.

To the extent that risk of cancer could then be estimated in relation to those exposures, the results could be extrapolated and would be more suitable for risk assessment applicable to settings and time periods in which the composition of metalworking fluids differed. This has been done in a general way, speculating about the effect of the many changes to remove known carcinogenic constituents, such as polynuclear aromatic hydrocarbons over the years, but has not been done systematically thus far. Even though the available data would not provide definitive information, the interpretation would be enhanced by careful consideration of exposure constituents.

The extrapolation of even the most valid epidemiologic evidence from past exposure conditions to those of the present requires explicitly addressing whether those changes matter with regard to cancer risk. To ignore the changes presumes that they do not matter despite compelling toxicological evidence suggesting that they would reduce if not eliminate carcinogenicity. It is possible, of course, that there are as yet undiscovered carcinogenic agents in present-day metalworking fluids, and thus epidemiologic studies are of value to address the impact of exposures incurred in the more recent past and present as well.

A brief summary of the epidemiological and toxicological studies on metalworking fluids is given in Tables 5 and 6.

Examination of the data in regard to NTP Criteria

The criteria used by NTP for classification of carcinogens are clearly stated:

> Known To Be Human Carcinogen: There is sufficient evidence of carcinogenicity from studies in humans, which indicates a causal relationship between exposure to the agent, substance, or mixture, and human cancer.
>
> Reasonably Anticipated To Be Human Carcinogen: There is limited evidence of carcinogenicity from studies in humans, which indicates that is credible, but that alternative explanations, such as chance, bias, or confounding factors, could not adequately be excluded,

There is an implicit assumption in both criteria that the studies in humans involve exposure to a single agent, substance or mixture. Just as it would be improper to combine studies on benzene and sodium chloride, it is unsound to combine studies on two metalworking fluids with no common components. The epidemiological data, at most, reflect exposures to a small, unknown number of mixtures of unknown composition in use over 30 years ago. Even for the mixtures studied, a causal relationship between exposure to those fluids and human cancer has not been shown. There are no studies of fluids in commerce after 1985 that would support classification of any, let alone all, metalworking fluids as causing cancer under any rational set of criteria. Because metalworking fluids comprise such a wide variability of composition, it is scientifically incorrect to view all metalworking fluids as one group for purposes of the RoC review.

Rationale for not listing metalworking fluids

None of the chemicals listed in Tables 1–4 are classified as known or listed carcinogens. Moreover, under the OSHA Hazard Communication Standard, each chemical that is used in a metalworking fluid composition is assessed for its suitability for use. Some MWF components, such as anti-microbials, are highly regulated and tens of millions of dollars have been spent on risk assessments for these components.

The properties of a pure substance or of a mixture of constant composition will not change over time. It would be meaningless to require retesting of benzene periodically to reaffirm that it would still be classified as a carcinogen. Such invariant materials can be safely listed as carcinogens or classed as non-carcinogens on the basis of testing. This is not true when mixture composition can vary and the classification can change as components are added or removed.

One reason for the diversity of metalworking fluids is the ability of many chemicals that can serve as emulsifiers, lubricants, corrosion inhibitors, and the like. A formulator has many options to choose from in developing a fluid. If the safety of a given chemical becomes suspect, replacement can be readily made without waiting for conclusive proof of hazard, as shown by the history of modifications given above. Changes can be (and have been) made solely to eliminate a suspect chemical, even in the absence of definitive evidence.

If all fluids were listed as carcinogens by definition, there would be no incentive to make marginal improvements in product safety. While formulation changes can be straightforward, there is still a burden in developing, optimizing and qualifying a new formula, and there is a risk in persuading a customer to make a switch without also changing suppliers.

NIOSH, OSHA and the courts have reviewed the epidemiology studies. None of these bodies found cause for regulatory action in the data.

The studies suggest, at best, there may have been associations in the past between exposure to some metalworking fluids and cancer. None of the associations were strong enough to support finding a causal relationship between exposure and cancer, at any body site, then or now. Metalworking fluids do not meet the criterion for a known human carcinogen.

Any association, even if real, between exposure to straight oils, soluble oils and a small number of synthetic or semi-synthetic fluids in the past would be irrelevant as "credible evidence" "reasonable expected to be a human carcinogen" for the fluids in use in the 21st century.

ILMA believes that there is insufficient information for NTP review and strongly urges the RG1 Subcommittee to terminate the nomination for metalworking fluids.

Tables

Table 1

Straight Oil Components

CHEMICAL	MAX % IN MRF
mineral oils	100
sulfurized fats	60
vegetable oils	60
chlorinated hydrocarbons	40
animal oils	30
fatty esters	30
polyol esters	30
petroleum sulfonates	20
oxidized waxes	10
phosphate esters	10
butadiene-styrene copolymers	1
polybutenes	1
polymethacrylates	1
polystyrenes	1
quinolines	1
alkylated aromatic amines	1

Table 2

Soluble Oil Components

CHEMICAL	WATER SOLUBLE	OIL SOLUBLE	IONIC CHARGE	MAX % IN MRF
mineral oils	-	+	0	100
sulfurized fats	-	+	0	60
vegetable oils	-	+	0	60
chlorinated hydrocarbons	-	+	0	40
animal oils	-	+	0	30
fatty esters	-	+	0	30
polyol esters		+	0	30
ethanolamines	+	-	+	25
petroleum sulfonates	-	+	-	20
oxidized waxes	-	+	0	10
phosphate esters	+	+	-	10
fatty acids	+	+	-	10
ethoxylated alcohols	some	some	0	5
ethoxylated alkylphenols	some	some	0	5
glycol ethers	+	+	0	5
boric acid	+	-	-	5
sulfonamido compounds	-	+	-	5
fatty alcohols	-	+	0	2
nitromorpholine compounds	-	+	0	2
silicones	-	-	0	2
sarcosines	+	-	-	2
alkylated aromatic amines	-	+	+	1
ethoxylated fatty amines	some	some	+	1
alkylated phenols	-	+	-	1
triazoles	+	-	-	1
dyes	+	+		
Odorants	+	+		

Table 3

Semi-synthetic Components

CHEMICAL	WATER SOLUBLE	OIL SOLUBLE	IONIC CHARGE	MAX % IN MRF
mineral oils	-	+	0	100
vegetable oils	-	+	0	60
chlorinated hydrocarbons	-	+	0	40
polyol esters		+	0	30
ethanolamines	+	-	+	25
petroleum sulfonates	-	+	-	20
phosphate esters	+	+	-	10
fatty acids	+	+	-	10
fatty amides	-	+	0	10
fatty diethanolamides	-	+	0	10
isopropanolamines	+	-	+	10
ethoxylated alcohols	some	some	0	5
ethoxylated alkylphenols	some	some	0	5
glycol ethers	+	+	0	5
boric acid	+	-	-	5
sulfonamido compounds	-	+	-	5
polyethers	+	-	0	5
triazines	+	-	0	5
imidazolines	+	-	-	5
pyridinethiols	+	-	-	5
oxazolidines	+	-	0	3
silicones	-	-	0	2
sarcosines	+	-	-	2
succinimides			0	2
triazoles	+	-	-	1
EDTA	+	-	-	1
mercaptobenzothiazoles	+	-	-	1
dyes	+	+		
odorants	+	+		
isothiazolines	+	-	0	

Table 4

Synthetic Components

CHEMICAL	WATER SOLUBLE	OIL SOLUBLE	IONIC CHARGE	MAX % IN MRF
ethanolamines	+	-	+	25
fatty acids	+	+	-	10
fatty amides	-	+	0	10
fatty diethanolamides	-	+	0	10
isopropanolamines	+	-	+	10
C9-C12 carboxylic acids	+	-	-	10
C9-C12 dicarboxylic acids	+	-	-	10
ethoxylated alcohols	some	some	0	5
ethoxylated alkylphenols	some	some	0	5
glycol ethers	+	+	0	5
boric acid	+	-	-	5
polyethers	+	-	0	5
triazines	+	-	0	5
imidazolines	+	-	-	5
pyridinethiols	+	-	-	5
glycols	+	-	0	5
oxazolidines	+	-	0	3
triazoles	+	-	-	1
EDTA	+	-	-	1
mercaptobenzothiazoles	+	-	-	1
cationic polymers	+	-	+	0.75
dyes	+	+		
odorants	+	+		
isothiazolines	+	-	0	

Table 5

Epidemiology Studies

STUDY		PERIOD OF EXPOSURE	FLUID CLASS	LOCATION
Decoufle 1978		1938-1968	Straight oil Soluble oil Synthetic	North central US
Aquavella 1991		1950-1967	"Cutting oil"	Iowa
Eisen 1992 et seq	Plant 1	1920-1984	Straight oil Soluble oil	Michigan
	Plant 2	1939-1984	Straight oil, Soluble oil Synthetic*	Michigan
	Plant 3	1920-1984	Straight oil	Michigan
Rotimi 1993	Male	1951-1984	Unknown	Ohio
	Female	1951-1984	Unknown	Ohio
Eisen 2001		1940-1994	Straight oil Soluble oil Synthetic**	Michigan
		1985-1994	Straight oil Soluble oil Synthetic**	Michigan
Roush 1982		1935-1973	"Cutting oil"	Connecticut
Jarvholm 1986		1950-1966	Synthetic or semi-synthetic	Sweden
Jarvholm 1981		1950-1966	Straight oils, Soluble oils	Sweden
Gallagher 1983		1950-1978	"Cutting oils"	British Columbia
Vena 1985		1938-1979	Unknown	New York
Park 1988		1911-1982	Mostly soluble oils	Connecticut
Silverstein 1988		1920-1982	Various	Connecticut
Tola 1988		1945-1960	Various	Finland
Jarvholm 1987		1950-1966	Straight oils, Soluble oils	Sweden
Mallin 1986			"Cutting oils"	Illinois
Russi 1997		1935-1991	Unknown	Connecticut
Park 1994		1966-1988	Unknown	Ohio
Jarvholm 1985		1954-1959	Straight oils	Sweden

* Semi-synthetic fluids classed as synthetics
** Semi-synthetic fluids classed as soluble oils

Table 6

Toxicology studies

STUDY/YEAR	FLUID TYPES	COMPOSITIONAL DETAILS	COMMENT
Gilman 1955	Soluble oil, straight oil	Unknown "sufurized" oils tested. Unused fluid, neat and diluted, used mixes	Too old to be seriously considered
Gupta 1989	Straight oil, soluble oil	Unknown oils of unknown composition	Sample was commercial fluid in India. 5% PNA content does not meet European standard of <3% Bioassay used a cancer promoter.
Jepsen 1977	Straight oils	Solvent-refined oil with "vegetable oil" additive; samples tested were unused, used and used after centrifugation.	Solvent refined oils may not have met modern standard for severely refined
McKee 1990	Fresh and used cutting fluids	Laboratory formulas of three base stock oils blended with 10% unknown additives, not commercial fluids.	Highly refined oils are not carcinogenic, nor are products formulated using non-carcinogenic additives. Industrial usage does not increase the carcinogenic potential.
McKee 1995	Lubricating oils with varying levels of PAH	Some information on processing, PAH content	Conducted by company knowledgeable about modern fluids, state of the art oil refining. Study was negative.
Evans 1989	Straight oil	PAH content was monitored over five years of use.	Total PAH content unchanged after 249 weeks of use, no change in carcinogenic potential.

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